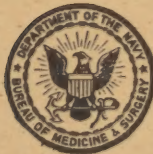


Am. ulenna

by

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INTRODUCTION

This key is offered to supply the need for an up-to-date taxonomic guide to the culicine mosquitoes of China. The only previous comprehensive key was that of Edwards (1922) which treated the adult mosquitoes of the entire Oriental Region. So many new species and so much biological information have been uncovered since 1922 that Edwards' key is now obsolete; in fact, the volume of Fauna of British India on Culicinae by Barraud (1934) is much more useful even though a considerable number of Chinese species are not included. Chinese taxonomic publications on mosquitoes in recent years have been mostly annotated check lists of certain geographical areas, and they have not included comprehensive keys.

In addition to the works of Edwards and Barraud mentioned above, the papers of Feng (1938) Borel (1926, 1928), Li and Wu (1934), Wu (1935) and Bohart (1945) have been particularly useful in the preparation of this work.

Of the 79 species of culicine mosquitoes recorded from China, 6 have not been found elsewhere. This endemism of less than 10 percent can be compared with a figure of nearly 50 percent of the more than 130 species and subspecies of the Philippine Islands. The species recorded so far only from China are Uranotaenia jacksoni Edwards, Heizmannia lii Wu, Aedes peipingensis Feng, Aedes fengi Edwards, Aedes yunnanensis Gaschen, and Culex jacksoni Edwards. It is obvious to anyone who studies the literature on Chinese mosquitoes that most of the collections have been made along the eastern coast and that the interior Provinces of Yunnan, Hunan, Honan, Shensi, Kweichow, Kansu, Shansi and Kwangsi must have a large fauna including many unrecorded and undescribed species.

The increasing medical importance of culicine mosquitoes is indicated by the large number of publications appearing since 1930 and dealing with disease transmission. None of the accepted mosquito-borne diseases of the Orient has been studied thoroughly from the vector standpoint, although careful studies have been made of malaria in certain geographical areas. Transmission studies of filariasis, dengue, and Japanese "B" encephalitis have been few, oftentimes inconclusive, and sometimes contradictory. Correct identification of the test mosquito will eliminate one possible source of error in the future.

This work was begun in September 1944 at the suggestion of Commander James J. Saperro (MC) USN. It was continued under the direction of Capt. Thomas M. Rivers, MC(8), USNR; commanding officer of U. S. Naval Medical Research Unit No. 2. While the paper is largely a compilation, it is based on a 4 months' study of the Oriental mosquitoes in the U. S. National Museum. Further information was obtained on Okinawa during a 3 months' field study of mosquito species, most of which occur also in China.

KEY TO THE GENERA OF CHINESE CULICINE MOSQUITOES

Key to Adults^{1/}

1. Proboscis with apical half curved and more slender than basal half; posterior margin of scutellum evenly rounded; clypeus broader than long.....Megarhinus
- Proboscis of uniform thickness, tapering evenly, or swollen apically; posterior margin of scutellum trilobed; clypeus longer than broad..... 2
2. Squama without a fringe; vein 6 not reaching beyond base of fork of vein 5..... 3
- Squama fringed; vein 6 reaching well beyond base of fork of vein 5..... 4
3. Wing membrane appearing clear at magnifications less than 80, anterior fork cell usually very short.....Uranotaenia
- Wing membrane with microtrichia visible under a magnification of 50 or less, anterior fork cell not usually very short ; proboscis very hairy and apically swollen.....Harpagomyia
4. Postspiracular bristles present..... 5
- Postspiracular bristles absent..... 7
5. Wing scales very broad and many asymmetrical; vertex with few or no broad appressed scales.....Mansonia (part)
- Wing scales not very broad and asymmetrical, or if so, with numerous broad appressed scales on vertex..... 6
6. Tarsi dark; median area of vertex and scutellum without narrow curved scales; torus, anterior pronotal lobe, proepimeron and pleuron with large patches of whitish scales.....Armigeres (part)
- Without above combination of characters.....Aedes
7. Spiracular bristles present..... 8
- Spiracular bristles absent..... 9
8. Fairly numerous hairs beneath on subcostal vein near base; male palpus long, apically spatulate.....Culiseta
- Base of subcostal vein without hairs; male palpus (in Chinese species) very short.....Tripteroides
9. Anterior pronotal lobes approximated behind the head; scutum without dorsocentral or prescutellar bristles.....Heizmannia
- Anterior pronotal lobes well separated; dorsocentral and prescutellar bristles well developed..... 10

^{1/} This key was taken with some modification from Bohart (1945).

10. Postspiracular area with broad appressed dark scales..... Armigeres (part)
 Postspiracular area bare..... 11
11. First fore tarsal segment longer than last 4 segments together, fifth segment longer than fourth; wing spotted..... Orthopodomyia
 First fore tarsal segment not longer than last 4 segments together 12
12. Proboscis apically swollen, especially in male; first fork cell of wing shorter than its stem, or wing with broad scales..... Ficalbia
 Proboscis not apically swollen..... 13
13. Pulvilli present..... Culex
 Pulvilli absent..... Mansonia (part)

KEY TO THE GENERA OF CHINESE CULICINE MOSQUITOES

2/

KEY TO LARVAE

1. Ventral fan or brush of anal segment composed of a single pair of hairs..... 2
 Ventral fan of anal segment of more than 2 separate hairs..... 3
2. Metathorax with a long spine on each side..... Tripteroides
 Metathorax without long spines..... Harpagomyia
3. Siphon with several ventral hair tufts, usually arranged in pairs..... Culex
 Siphon with not more than one ventral hair tuft..... 4
4. Siphon short and conical, valves large, black and modified for piercing; 2 long spines arising from valves; no pecten..... Mansonia
 Characters not as above..... 5
5. Upper and lower head hairs (C&B), or one of them usually very thick and spinelike; pecten teeth scale-like or fringed on both sides..... Uranotaenia
 Upper and lower head hairs bristle-like or hair-like; pecten teeth simple or fringed on one side only..... 6
6. Comb teeth of alternating large and small teeth in a row..... Orthopodomyia
 Comb teeth not of 2 alternating sizes..... 7
7. Siphon tuft inserted near extreme base of tube; comb (in Chinese species) a patch of many teeth..... Culiseta

2/ This key was taken with some modification from Barraud (1934)

Siphon tuft inserted near middle of tube or beyond; if at base (as in *Ficalbia minima*),
comb teeth in a line.....Aedes, Armigeres, Heizmannia 3/, Ficalbia

Genus MEGARHINUS Robineau-Desvoidy

Megarhinus splendens is a widely distributed large mosquito which does not feed upon man. The larvae occur in tree holes, bamboos, and artificial receptacles where they are predaceous on other larvae. *M. kemp*i has similar habits and is usually found breeding in bamboos. It occurs in India, Java, Cochín China and probably in south China.

KEY TO THE CHINESE SPECIES OF MEGARHINUS

Key to Adults

Abdomen with conspicuous lateral hair tufts on VI to VIII, those on VII black, on VIII
tawny; scutal scales mostly dull bronze or greenish; last hind tarsal segment dark
.....splendens (Wiedemann)

Abdomen without conspicuous lateral hair tufts; scutal scales a brilliant metallic
green; last hind tarsal segment white.....kempi Edwards

Key to Larvae

Dorso-lateral plate of seventh abdominal segment carrying 2 bristles and 3 hairs
.....splendens (Wiedemann)

This plate with 1 bristle and 4 hairs.....kempi Edwards

Genus TRIPTEROIDES Giles

The two Chinese species of this genus appear to have no medical significance. They occur primarily in tree holes or in bamboo. *T. vicina* Edwards has a wide distribution in China and Malaya. *T. bambusa* occurs in southeast China and southern Japan. Both species have the head broadly blue-banded in front, scutum dark brown except around front margins, femora with silvery spots, and abdomen with lateral silvery markings,

KEY TO THE CHINESE SPECIES OF TRIPTEROIDES

Key to Adults

Proepimeron with a few narrow curved scales; larger claw of fore leg in male with a
slight notch.....bambusa (Yamada)

Proepimeron with a few small broad appressed scales; larger claw of fore leg in
male with a distinct tooth.....vicina (Edwards)

3/ The larva of the only known Chinese species of this genus, H. lii Wu, has not been described.

Key to Larvae

- Metathoracic spine with 2 branches, one about half as long as the other.....vicina (Edwards)
- Metathoracic spine of 3 or 4 branches, each about half the length of the next.....
.....bambusa (Yamada)

Genus HARPAGOMYIA de Meijere

The single Chinese species of this genus, Harpagomyia genurostris (Leicester), is widespread in the Oriental Region. It apparently does not attack man but takes nourishment from ants. Larvae occur in leaf axils and possess the following characters:

Pale yellowish, flattened dorso-ventrally, anal fan of a single pair of fine hairs; comb in a patch of about 40 teeth; siphon tapering, with scattered hairs of various lengths, pecten irregular; lateral hair of anal segment with one very long branch; anal gills large and long.

Genus URANOTAENIA Lynch Arribalzaga

Five species of this genus have been reported from China, bimaculata from Anhwei and Kwangtung Provinces; macfarlanei from Chekiang, Kiangsi and Kwangtung; annandalei from Fukien and Kwangtung; testacea from Chekiang, Kiangsi and Kwangtung; and jacksoni from Kwangtung. With the exception of jacksoni, all of the species occur in India and other parts of the Oriental Region. Very little is known about the habits of the adults. Larvae of annandalei and macfarlanei have been collected in sandy stream bed pools. Larvae of bimaculata occur in treeholes, bamboos and artificial containers.

KEY TO THE CHINESE SPECIES OF URANOTAENIA

Key to Adults

1. With a line of bluish-white scales across the pleuron; wing entirely dark scaled..... 2
Pleuron without bluish-white scales..... 3
2. Hind tarsus unicolorous; scutum with a patch of greyish-brown scales in front of wing base.....annandalei Barraud
Hind tarsus with most of third and all of fourth and fifth segments creamy white; scutum without pale scales in front of wing base.....testacea Theobald
3. Scutum with a lateral oval black spot in front of wing base; pleural integument dark greyish brown.....bimaculata Leicester
Scutum not spotted..... 4
4. Abdominal tergites with pale apical bands or spots; pleural integument black with a longitudinal dull white line of scales.....macfarlanei Edwards
Abdominal tergites with pale basal bands; pleuron pale yellow with dark markings at upper corner of sternopleuron and on postspiracular area, proepimeron also dark
.....jacksoni Edwards

Key to Larvae 4/

1. Antenna of bizarre form and with 3 large leaf-like appendages, antennal hair at apical one-fourth; comb plates connected by a broad dorsal saddle, comb of about 4 teeth annandalei Barraud
- Antenna of normal form, comb of more than 4 teeth..... 2
2. Upper and lower head hairs (C&B) stout and spine-like; antennal hair at basal one-third; comb of about 10 sharply pointed teeth.....macfarlanei Edwards
- Upper and lower head hairs not spine-like; antennal hair at apical one-third; comb of about 8 apically fringed teethbimaculata Leicester

Genus ORTHOPODOMYIA Theobald

Orthopodomyia anopheloides (Giles) is the only species so far recorded from China (Chekiang). It also occurs in India, Burma, and Indochina. Larvae are found in tree holes and bamboo stumps. According to Barraud (1934), the larva is distinguished by having a large sclerotized saddle on the seventh abdominal segment, a separate lateral sclerotized strip at the base of the anal segment on each side, and long lateral branches on the larger comb teeth.

Although some species of Orthopodomyia will attack man, the genus is considered of no medical importance.

Genus MANSONIA Blanchard

Three species are known from China, uniformis, crassipes, and ochracea. All have a wide distribution in the Oriental Region.

The larvae of Mansonia live submerged in weedy ponds and puncture the air tubes of aquatic plants with their peculiar siphon tubes. The adults bite humans readily and uniformis has been proven by Feng (1934) to carry Wuchereria bancrofti in China.

KEY TO THE CHINESE SPECIES OF MANSONIA 5/

Key to Adults

1. Wing scales nearly all broad and asymmetrical; eighth sternite of female small and armed with hooks or teeth; scutum with scales mostly in longitudinal lines leaving a broad central stripe of brown scales on anterior two-thirds.....uniformis (Theobald)
- Wing scales mostly narrow and lanceolate; eighth tergite of female larger, without teeth; scutum not lined..... 2
2. Wings mostly dark scaled; proboscis, palpus and legs mostly dark with purplish reflection; male dististyle with a slender inconspicuous subbasal inner projectioncrassipes (van der Wulp)

4/ Larvae of U. testacea and jacksoni are unknown.

5/ Mansonia aurites (Theobald) has been recorded from Hangchow (Chekiang Province) but the species is African and its occurrence in China is doubtful.

Wings mostly yellow scaled; proboscis, palpus and legs mostly yellowish with some purplish areas; male dististyle irregularly subtriangular and without projections ochracea Theobald)

Key to Larvae 6/

Portion of antenna beyond subapical bristles about one-third as long as rest of antenna, and not flexible; head hairs B and C very small; anal segment with about 4 ventral tufts before the anal fan; comb usually of 2 strong teeth..... uniformis (Theobald)

Portion of antenna beyond subapical bristles longer than rest of antenna and flexible; head hairs B and C small but well developed; anal segment without ventral tufts before the anal fan; comb of 5 to 8 teeth in a row..... ochracea (Theobald)

Genus HEIZMANNIA Ludlow

This genus is composed of small Aedes-like mosquitoes which have a tuft of hairlike scales on the postnotum. This character distinguishes them from all other recorded Chinese mosquitoes. The single known Chinese species, H. lii Wu, has been collected only in Chekiang Province (Hangchow and Tienmushan). It was bred from larvae in bamboo stumps and the adult habits are unknown. According to the original description of lii (Wu, 1936), it closely resembles H. complex (Theobald) in having the proboscis about as long as the front femur, the scutellum dark, the anterior pronotal lobes large and silvery, and the scutal scales dull greyish brown. Wu's species differs in having a simple dististyle, resembling that of metallica (Leicester), rather than a divided one as in complex. Also, the abdomen has some complete narrow basal white bands on the dorsum in lii. The larvae have not been described but are presumably similar to those of Aedes.

Genus FICALBIA Theobald

The two Chinese species of this genus, minima and luzonensis have a wide distribution in the Oriental region. Chinese records are from Kwangtung Province (Hongkong).

The larvae presumably occur in weedy ponds or swamps. They resemble Aedes in many respects and for convenience they are included in the key to the Aedes larvae (page). The adults have not been reported to attack man.

KEY TO THE CHINESE SPECIES OF FICALBIA

Key to Adults

Wing speckled with pale and dark scales; scutellum with broad appressed brown and white scales; median area of vertex with narrow curved white scales; palpus of male about three-fourths as long as proboscis luzonensis (Ludlow)

Wing not speckled; scutellum with narrow curved scales only; vertex mostly with broad appressed greyish or ochreous scales; palpus of male about one-eighth proboscis which is strongly swollen apically minima (Theobald)

6/ The larvae of M. crassipes and ochracea have not been distinguished. The key characters, which are based on a larval description of Edwards and Given (1928), might apply to either species

Genus ARMIGERES Theobald

The four Chinese species of this genus, malayi, subalbatus, aureolineatus and magnus, have a wide distribution in the Oriental region. Armigeres larvae resemble those of Aedes in many ways, differing principally in the absence of a pecten. For convenience the larvae of both genera are included in a single key (page 12). The larvae of subalbatus and malayi prefer foul water in artificial containers, those of magnus occur in pitcher plants and those of aureolineatus are often found in coconut shells. The commonest species in China is subalbatus (formerly known there as obturbans (Walker), a Malaysian and Indian species). The larvae of subalbatus seem to prefer water in artificial containers which is grossly polluted with garbage or fecal matter. The adults bite in the shade during the day, and at night. The species is under suspicion as a carrier of Wuchereria bancrofti, early stages of which have been recovered from the mosquitoes in nature.

KEY TO THE CHINESE SPECIES OF ARMIGERES

Key to Adults

1. Pleuron with some dark broad appressed scales on postspiracular area but without postspiracular bristles; female palpus about two-thirds as long as proboscis; dististyle of male genitalia with toothlike setae at apical margin; nape chiefly with pale upright forked scales; postnotum bare; abdominal tergites with median basal yellowish marks as well as lateral white spots.....magnus (Theobald)
- Pleuron with pale scales only, postspiracular area with a few bristles; female palpus not more than one-third as long as proboscis; dististyle of male genitalia with toothlike setae along inner edge; nape with dark upright forked scales, abdominal tergites black with white lateral spots..... 2
2. Thorax with distinct fine golden lines; male dististyle subtriangular, mesosome with a pair of outwardly directed prongs apically.....aureolineatus (Leicester)
- Thorax with indistinct whitish or greyish lines at most; mesosome without apical prongs..... 3
3. Clypeus with a patch of silvery scales on either side; male genitalia with basal lobe of dististyle bearing one long strong seta and a group of smaller setae; parameres apically hooked.....malayi (Theobald)
- Clypeus bare; male genitalia with dististyle with more than one strong seta, dististyle not reaching to middle of this seta when depressed; parameres not hooked.....subalbatus (Coquillett)

Genus AEDES Meigen

Transmission of filariasis.--Although dissections of mosquitoes collected in nature and of those experimentally infected have not been carried out on many species of Aedes, this genus seems generally unsuited for the transmission of filariasis. However, Yamada (1921) reported experimental infection of togoi in 14 out of 20 specimens with Wuchereria bancrofti. Ninety-six cent of the filarial larvae reached the infective stage. Feng (1931) recorded the capture of albopictus naturally infected with W. bancrofti larvae in early stages of development. No infective larvae have been obtained from albopictus, however, either in nature or experimentally.

Transmission of dengue.--Aedes aegypti and Aedes albopictus are well known as carriers of dengue. Both species are common in China.

Transmission of Japanese "B" encephalitis.--Japanese and Russian investigators have experimentally proven Aedes togoi, albopictus and japonicus capable of transmitting the disease to laboratory animals.

Distribution.--The distribution of Chinese Aedes is tabulated below (that within China is given in parenthesis).

Widely Distributed in the Oriental Region

aegypti (southeast coast)
albolineatus (south)
albopictus (widespread)
annandalei (middle east coast)
lineatopennis (southeast coast)
niveus (southeast coast)
vexans nipponii (widespread)
w-albus (south)

Principally India, Burma, Indochina and China

elsiae (middle east coast)
macdougalli (south)
macfarlanei (south)
niveoides (south)
prominens (middle east coast)
pseudalbopictus (middle east coast)
scatophagoides (south)

Throughout Palearctic Region
dorsalis (northeast)
maculatus (northeast)

East Asia Coast to South China
togoi (whole east coast)

Japan, Formosa and China
japonicus (southeast coast)

Japan and China
chemulpoensis (northeast)

Formosa and China
hatorii (middle east coast)

Korea and China
koreicus (northeast)
seoulensis (northeast)

China only
fengi (middle east coast)
peipingensis (northeast)
yunnanensis (southwest)

Larval habitat.--The larvae occur most often in the following preferred habitats:

Tree holes and bamboos

albolineatus
albopictus
annandalei
chemulpoensis
fengi
niveoides
niveus
peipingensis
prominens
pseudalbopictus
seoulensis

Rock pools and stream-bed pools

elsiae
japonicus
koreicus
macdougalli
macfarlanei
yunnanensis

Temporary Rain Pools

lineatopennis
vexans nipponii

Swamps and semipermanent ground pools

dorsalis
maculatus
scatophagoides

Artificial Containers

aegypti
albopictus

Brackish Pools

dorsalis
togoi

Classification.--The 26 known species of Chinese Aedes belong to six subgenera as tabulated below:

FINLAYA Theobald	OCHLEROTATUS L. Arribal.	STEGOMYIA Theobald
<u>elsiae</u>	<u>maculatus</u>	<u>albolineatus</u>
<u>fengi</u>	<u>dorsalis</u>	<u>albopictus</u>
<u>hatorii</u>		<u>aegypti</u>
<u>japonicus</u>	MUCIDUS Theobald	<u>annandalei</u>
<u>koreicus</u>	<u>scatophagoides</u>	<u>chemulpoensis</u>
<u>macdougalli</u>		<u>pseudalbopictus</u>
<u>macfarlanei</u>	AEDIMORPHUS Theobald	<u>w-albus</u>
<u>niveoides</u>	<u>vexans nipponii</u>	
<u>niveus</u>		
<u>peipingensis</u>	BANKSINELLA Theobald	
<u>prominens</u>	<u>lineatopennis</u>	
<u>seoulensis</u>		
<u>togoi</u>		
<u>yunnanensis</u>		

KEY TO THE CHINESE SPECIES OF AEDES

Key to Adults

1. Scutellum with narrow curved scales only..... 2
 Scutellum with some broad appressed scales..... 14
2. Crossveins clouded, wings with pale and dark scales, body and legs with a mottled and mouldy appearance imparted by long twisted erect scales..... scatophagoides Theobald
 Crossveins not clouded..... 3
3. Tarsi all dark; abdominal tergites with narrow basal bands..... 4
 Tarsi pale marked..... 6
4. Scutum with a double median line of cream-colored scales which forks posteriorly, and with indefinite submedian and lateral lines and patches; palpi pale marked..... yunnanensis Gaschen
 Scutum without a double median pale line which forks posteriorly; palpi dark..... 5
5. Scutum with broad lateral golden margins..... lineatopennis (Ludlow)
 Scutum in female with poorly defined whitish areas consisting of lateral patches and sometimes a discernible short median double line, in male mostly whitish except for a small central area..... peipingensis Feng
6. Wings speckled with white and dark scales; femora speckled..... 7
 Wings entirely dark scaled..... 8

7. Last hind tarsal all white.....	<u>dorsalis</u> (Meigen)	
Last hind tarsal with apical one-third to two-thirds dark.....	<u>maculatus</u> (Meigen)	
8. Scutum without a linear pattern or large silvery areas; male dististyle flat and blade-like; median area of vertex with abundant yellowish curved scales; tarsal rings narrow.....	<u>vexans nipponii</u> (Theobald)	
Scutum with a linear pattern or large silvery areas.....		9
9. Scutum with a large white patch covering anterior half and with white scales framing the antescutellar area; first and second hind tarsals with basal and apical white bands, third and fourth hind tarsals with basal pale scales, fifth hind tarsal dark	<u>seoulensis</u> Yamada	
Scutum with a linear pattern.....		10
10. All hind tarsal segments pale marked.....		11
Pale marks on first 4 hind tarsals at most.....		13
11. Last hind tarsal all pale; scutal pattern composed essentially of 5 narrow lines, the middle one more or less double; proboscis with some pale scaled areas; most of abdominal tergites with a pair of submedian creamy spots.....	<u>macfarlanei</u> Edwards	
Last hind tarsal pale at base only.....		12
12. Scutum with sharply defined narrow pale golden lines; palpi entirely dark.....	<u>koreicus</u> Edwards	
Scutum with indistinct cream-colored lines, linear pattern best seen in fresh female specimens; palpi not all dark.....	<u>togoi</u> (Theobald)	
13. Mid tibia all dark; tarsi with basal white rings on first 2 segments and third hind tarsal.....	<u>fengi</u> Edwards	
Mid tibia not all dark; hind tarsus with bands covering the joints of first four segments	<u>macdougalli</u> Edwards	
14. Tarsi uniformly colored; scutum with a large silvery anterior patch which is sometimes divided.....		15
Tarsi pale marked.....		16
15. Lobes of ninth tergite of male each with 4 to 5 strong hairs.....	<u>niveus</u> (Ludlow)	
Lobes of ninth tergite of male each with 2 to 3 strong hairs.....	<u>niveoides</u> Barraud	
16. Last hind tarsal not all white.....		17
Last hind tarsal all white.....		21
17. Hind tarsus with basal and apical pale marks on some segments.....		18
Hind tarsal segments with basal pale marks only.....		19

18. Scutum with a double median yellowish line, with submedian and sublateral lines; anterior pronotal lobe and proepimeron with a mixture of broad appressed black and white, and narrow yellowish scales; hind tarsus with pale markings on first 4 segments; broad appressed pale and dark scales on mid lobe of scutellum, narrow curved yellowish scales on lateral lobes.....elsiae Barraud
- Scutum with a large anterior whitish patch; hind tarsus with pale markings on first 3 segments; scutellar scales broad, dark in female but white in male; center of abdomen with tufts of very long erect scales.....prominens Barraud
19. Scutum with narrow golden lines; hind tarsus with basal pale marks on first 3 segments.....japonicus (Theobald)
- Scutum without golden lines; tarsal markings not as above..... 20
20. Mid femur with a round white spot at middle on anterior surface; scutum with white patches which are sometimes connected in front to form a rough W.....w-albus (Theobald)*
- Mid femur without a round white spot at middle on anterior surface..... 21
21. Scutum with a large anterior rounded whitish patch; hind tarsus with basal pale marks on first, second and fourth segments, third all dark; anterior pronotal lobe and proepimeron with broad appressed white scales.....annandalei Theobald
- Scutum with a median silvery stripe reaching as far posteriorly as the wing bases; first 4 hind tarsal segments with basal pale marks; anterior pronotal lobe and proepimeron dark.....albolineatus (Theobald)
22. Scutum with a prominent narrow median pale stripe reaching about as far posteriorly as wing bases..... 23
- Scutum with different ornamentation..... 24
23. Ninth tergite in male produced medially into a blunt point; basal lobe of basistyle short and stout.....albopictus (Skuse)
- Ninth tergite in male nearly flat medially; basal lobe of basistyle long, narrow and with a strong spine at inner two-thirds.....pseudalbopictus Borel
24. Scutum with a distinct lyre-shaped pattern.....aegypti (Linnaeus)
- Scutum without a lyre-shaped pattern..... 25
25. Scutal pattern essentially composed of 2 large shoulder patches, about 6 small spots and 2 short sublateral posterior lines.....chemulpoensis Yamada
- Scutal pattern essentially composed of 5 rather narrow lines, the middle line more or less double and forking posteriorly; proboscis dark; most of abdominal tergites with broad basal white bands; white line on anterior surface of hind femur interrupted at apical two-thirds.....hatorii Yamada

* This species is very similar to and perhaps synonymous with the Philippine gardnerii (Ludlow). The main difference seems to be that w-albus has a heavier dark subapical ring on the hind femur.

Key to Larvae 7/ Including Armigeres and Ficalbia

1. Siphon without a pecten..... 2
 Siphon with at least 2 pecten teeth..... 6
2. Siphon about 5 times its basal breadth, with a bifid hair near basal one-third, anal gills moderately small and slender; comb in a regular row; lateral saddle hair of anal segment very long and single.....Ficalbia luzonensis (Ludlow)
 Siphon hardly twice as long as broad, tuft of few branches inserted sublaterally at about apical two-thirds; anal gills very long and broad; lateral hair of anal segment small, of several branches, and not inserted on the saddle..... 3
3. Comb teeth deeply divided and frayed apically; mediolateral tuft of eighth abdominal segment with 2 or 3 branches.....Armigeres magnus (Theobald)
 Comb teeth sometimes fringed but not divided; mediolateral tuft of eighth abdominal segment with at least 6 branches..... 4
4. Comb teeth not fringed.....Armigeres malayi (Theobald)
 Comb teeth fringed..... 5
5. Comb of 6 to 12 teeth in an irregular double row.....Armigeres subalbatus (Coquillett)
 Comb of 5 to 6 teeth.....Armigeres aureolineatus (Leicester) 8/
6. Siphon tuft well developed and inserted near base of tube which is about 2.7 times as long as its basal breadth; 2 strong simple pecten teeth; comb of 6 to 8 large teeth in a regular row; preclypeal spines stout and barbed.....Ficalbia minima (Theobald)
 Siphon tuft well removed from base of tube..... 7
7. Comb in a single or partially double row..... 8
 Comb of 15 to 70 scales in a patch..... 17
8. Body with numerous stellate hairs..... 9
 Body without stellate hairs..... 10
9. Upper and lower head hairs (C and B) simple; saddle hair of anal segment many branched.....Aedes chemulpoensis Yamada
 Lower head hair (B) multiple, upper head hair (C) single or multiple; saddle hair not more than 3-branched; anal gills very short.....Aedes albolineatus (Theobald)

7/ Larvae of Aedes peipingensis Feng, w-albus (Theobald), and hatorii Yamada are unknown. Larva of fengi as described and figured by Li and Wu (1935b) runs to albopictus but the comb teeth are blunt and fringed nearly to the tip.

8/ The larva of this species has not been adequately described.

10. One or more distal pecten teeth more widely spaced; comb irregular; antennal hair with 5 or more branches..... 11
- Pecten teeth fairly regularly spaced..... 12
11. Both upper and lower head hairs (C and B) with 4 or more branches; antennal hair tuft inserted at middle of shaft..... Aedes lineatopennis (Ludlow)
- One or both head hairs (C and B) with fewer than 4 branches, lower head hair most often single; antennal hair tuft inserted before middle of shaft.....
..... Aedes vexans nipponii (Theobald)
12. Both upper and lower head hairs (C and B) with more than 4 branches..... 13
- One or both head hairs usually simple, in any case with fewer than 4 branches..... 14
13. With 16 to 19 comb scales; siphon about 2.5 times as long as its basal breadth.....
..... Aedes niveus (Ludlow) 9/
- With 8 to 10 comb scales; siphon nearly 5 times as long as its basal breadth.....
..... Aedes niveoides Barraud
14. Comb teeth on a sclerotized plate, simple and 5-6 in number; antennal hair a very short bristle inserted slightly beyond middle of shaft; upper head hair (C) usually simple, lower head hair (B) usually triple..... Aedes annandalei Theobald
- Comb teeth not on a sclerotized plate..... 15
15. Antennal hair almost exactly at middle of shaft..... Aedes pseudalbopictus Borel
- Antennal hair inserted slightly beyond middle of shaft..... 16
16. Comb teeth with several strong sub-teeth on each side..... Aedes aegypti (Linnaeus)
- Comb teeth nearly simple, slightly fringed toward base..... Aedes albopictus (Skuse)
- 17 Head hairs B and C, or at least one of them with fewer than 3 branches..... 18
- Head hairs B and C both with 3 or more branches..... 21
18. Mouth brushes composed of thickened hairs adapted to a predaceous habit; anal fan extending along whole length of segment ventrally; head hairs B and C single.....
..... Aedes scatophagoides Theobald
- Mouth brushes normal; anal fan restricted to postero-ventral area of segment..... 19
19. Antennal hair simple; siphon hardly twice its basal breadth..... Aedes prominens Barraud
- Antennal hair multiple; siphon about 2.5 times as long as its basal breadth..... 20
20. Anal brush with 5 or 6 small hair tufts before barred area; gills as long as saddle...
..... Aedes maculatus (Meigen)
- Anal brush with 3 such tufts at most; gills very short and globular.....
..... Aedes dorsalis (Meigen)
- 9/ Feng (1938) has described from Peiping, under the name niveus, larvae and adults of a form intermediate between niveus and niveoides. The larva has 10-12 comb teeth and a siphon about 3 times its basal breadth.

21. Dorsum of thorax with a strong mediolateral spine on a sclerotized plate on meso- and methathorax.....	22
Dorsum of thorax without such spines.....	23
22. Thoracic spines simple; siphonal tuft of 6-8 branches.....	<u>Aedes elsiae</u> Barraud
Mesothoracic spine double, the branches unequal; metathoracic spine basally barbed; siphonal tuft of 4-5 branches.....	<u>Aedes macfarlanei</u> Edwards
23. Abdomen with some stellate hairs; antennal hair simple.....	24
Abdomen without stellate hairs.....	25
24. Head haird(located more medially than B and C) very small.....	<u>Aedes macedougalli</u> Edwards
Head haird about as large and similar to B and C.....	<u>Aedes seoulensis</u> Yamada
25. Apical few pecten teeth much longer than those toward base of siphon.....	26
Apical few pecten teeth not conspicuously longer than those toward base of siphon...	27
26. Last pecten tooth almost reaching apex of tube; siphon tuft not or hardly reaching apex of tube; anal gills moderately long.....	<u>Aedes japonicus</u> (Theobald)
Last pecten tooth reaching not farther than apical three fourths of tube; siphon tuft very large, reaching far beyond apex of tube; anal gills very short and globular.....	<u>Aedes togoi</u> (Theobald)
27. Siphon tuft inserted well beyond middle of tube.....	<u>Aedes yunnanensis</u> Gaschen
Siphon tuft inserted about at middle of tube.....	<u>Aedes koreicus</u> Edwards

Genus CULISETA Felt 10/

The only known Chinese representative of this genus is Culiseta niveitaeniata (Theobald) which has been recorded from Yunnan as well as from India and Tibet. Barraud (1934) states that the larva has well branched head hairs, a comb of about 50 teeth in a patch, siphon with a well developed pair of subbasal ventral tufts, pecten forming a row of short teeth and a row of bristles which reach to the apical fourth of the siphon, and gills long and pointed.

The adults attack man but are not known to be associated with any disease in the Orient.

Genus CULEX Linnaeus

Transmission of filariasis.--Culex quinquefasciatus and pipiens pallens have frequently been collected in nature containing infective larvae of Wuchereria bancrofti. They are generally considered the chief vectors of this type of filariasis in China. In addition, tritaeniorhynchus has been found carrying immature larvae by Feng (1931). Other Chinese workers have experimentally reared W. bancrofti to the infective stage in Culex pipiens pallens, quinquefasciatus, vagans, vorax, fuscanus, tritaeniorhynchus, and bitaeniorhynchus.

Much less is known of the vectors of Wuchereria malayi. Experimental evidence indicates that Anopheles hyrcanus sinensis Wiedemann and Mansonia uniformis Theobald are more suitable
10/ Treated by most previous authors as Theobaldia Neveu-Lemaire.

vectors than Culex. Also, sandflies (Phlebotomus spp.) have been found naturally infected. However, laboratory experiments have been reported in which infective larvae were recovered in a small percentage of cases from Culex pipiens pallens, tritaeniorhynchus, and vorax.

Transmission of Japanese "B" encephalitis.--Russian and Japanese investigators have isolated the virus from Culex pipiens pallens and tritaeniorhynchus collected in nature. These two species, as well as three species of Aedes, were also used to transmit the virus to laboratory animals.

Distribution.--The distribution of Chinese Culex in the Orient is summarized below (that within China is given in parenthesis).

Widely distributed in the

Oriental Region

aurantapex (south)
bitaeniorhynchus (whole east coast)
brevipalpis (southeast coast)
fuscus (southeast coast)
fuscocephalus (southeast coast)
gelidus (south)
halifaxii (south)
malayi (southeast coast)
mimeticus (widespread)
mimulus (south)
minutissimus (south)
pallidothorax (southeast coast)
quinquefasciatus (whole south half)
rubithoracis (southeast coast)
sinensis (southeast coast)
sitiens (southeast coast)
tritaeniorhynchus (widespread)
vishnui (widespread)
whitmorei (southeast coast)

Principally India, Burma, Indo-China, and China

modestus (northeast)
shebbearei (southeast coast)
theileri (south)
vagans (widespread)
vorax (whole east coast)

Sumatra and China

sumatranus (south)

Java and China

foliatus (southeast coast)

Thailand and China

infantulus (southeast coast)

Japan and China

hayashii (northeast)
pipiens pallens (northeast)
orientalis (whole east coast)

China only

jacksoni (south)

Larval habitat.--Chinese Culex can be grouped according to preferred habitats as follows:

Semipermanent ground

pools

fuscocephalus
gelidus
modestus
theileri
tritaeniorhynchus
vagans
vishnui
whitmorei

Brackish Pools

sitiens

Artificial containers and

polluted ground pools

fuscus
halifaxii
pallidothorax
pipiens pallens
quinquefasciatus
vorax

Tree holes and bamboos

brevipalpis
shebbearei

Springs and stream

pools

foliatus
hayashii
infantulus
malayi
minutissimus

Pitcher plants

brevipalpis
sumatranus

Classification. --The 31 known species of Chinese Culex are arranged in subgenera as follows:

LUTZIA Theobald

fuscus
halifaxii
vorax

BARRAUDIUS Edwards

modestus

NEOCULEX Dyar

brevipalpis
hayashii
sumatranus

MOCHTHOGENES Edwards

foliatus
malayi

LOPHOCERAOMYIA Theobald

infantulus
minutissimus
rubithoracis

CULICIOMYIA Theobald

pallidothorax
shebbearei

CULEX Linnaeus

aurantapex
bitaeniorhynchus
fuscocephalus
gelidus
jacksoni
nimeticus
mimulus
orientalis
pipiens pallens
quinquefasciatus
sinensis
sitiens
theileri
tritaeniorhynchus
vagans
vishnui
whitmorei

KEY TO THE CHINESE SPECIES OF CULEX

Key to Adults

1. Tarsi with pale bands or at least a speckling of pale scales on more than one segment; proboscis usually pale marked..... 2
Tarsi without pale bands and not speckled (except on first hind tarsal in theileri); proboscis usually dark..... 16
2. Tarsi with a speckling of pale scales but without distinct bands; 4 or more lower mesepimeral bristles present..... 3
Tarsi with some distinct pale bands; fewer than 4 mesepimeral bristles present; proboscis with a distinct pale ring..... 5
3. Abdominal tergites entirely dark or with restricted markings; lateral plate of male mesosome with a strong toothed process..... halifaxii Theobald
Abdominal tergites with broad pale markings..... 4
4. Second to fourth abdominal tergites with narrow apical bands or dark, fifth to seventh broadly pale; lateral plate of male mesosome without a strong toothed process.....
.....fuscus Wiedemann
Abdominal tergal bands all about the same width; lateral plate of male mesosome with a strong toothed process.....vorax Edwards
5. Wings with distinct spots of pale scales..... 6
Wings sometimes speckled but not spotted..... 9

6. First pale costal spot (at middle of wing) extending only onto subcosta.....	7
First pale costal spot extending over vein 1.....	8
7. Scutum with a distinct mottling of light and dark scales.....	<u>mimeticus</u> Noë 11/
Scutal scales uniformly reddish brown.....	<u>jacksoni</u> Edwards 11/
8. First pale costal spot not extending beyond vein 1; vein 5.2 dark apically.....	<u>mimulus</u> Edwards
First pale costal spot extending over vein 4; vein 5.2 broadly pale apically.....	<u>orientalis</u> Edwards
9. Femora not speckled; abdomen with basal tergal bands on some segments; wings dark scaled.....	10
Femora speckled with pale and dark scales.....	11
10. Scutum uniformly clothed with dark brown scales; male palpus dark apically; mesosome of male genitalia with several posterior teeth of about equal length on lateral plate.....	<u>tritaeniorhynchus</u> Giles
Scutum brown with patches of paler scales; male palpus white-tipped; lateral plate of mesosome in male genitalia with one or two long posterior teeth directed caudally in addition to a few smaller teeth.....	<u>vishnui</u> Theobald
11. Scutum mainly brownish or golden scaled with a few paler scales.....	12
Scutal scales mainly whitish or greyish, at least on anterior two-thirds.....	14
12. Wing scales dark, abdominal tergites with basal, evenly margined bands, at least on II to IV.....	<u>sitiens</u> Wiedemann
Wing speckled with numerous pale scales; abdominal tergites with yellowish apical bands or patches, at least on VI to VIII.....	13
13. Scutal scales mostly golden brown anteriorly and dark brown posteriorly.....	<u>bitaeniorhynchus</u> Giles
Scutal scales almost all black; last few abdominal tergites entirely orange.....	<u>aurantapex</u> Edwards
14. Abdominal tergites apically banded; scutal scales mostly pale ochreous or greyish white on anterior two-thirds of scutum.....	<u>sinensis</u> Theobald
Abdominal tergites banded or spotted basally; scutal scales white on anterior 2/3 of scutum.....	15
15. Posterior one-third of scutum entirely dark scaled; scutellar scales golden; wing scales not unusually broad.....	<u>gelidus</u> Theobald
Scutal area back of wing bases variegated with whitish scales; scutellar scales at least partly whitish; some wing scales.....	<u>whitmorei</u> (Giles)

11/ According to Edwards (1935), the distinction between these two species does not hold good although larvae appear to be distinct.

16. Median area of vertex including eye margins, with narrow scales only.....	17
Median area of vertex with some broad appressed scales, at least along eye margins; pleuron unscaled.....	25
17. Abdomen banded dorsally.....	18
Abdomen unbanded.....	21
18. Fore and mid femora and all tibiae conspicuously striped in front.....	19
Fore and mid femora all dark in front.....	20
19. Hind femur with a brown line beneath on apical third..... <u>theileri</u> Theobald	
Hind femur pale beneath from base to apex..... <u>vagans</u> Wiedemann	
20. Scutal scales ochreous tinged; bands of abdominal tergites in female rather rounded apically; second division of male mesosome very broad and plate-like.....	
..... <u>quinquefasciatus</u> Say	
Scutal scales generally reddish brown; bands of abdominal tergites in female nearly straight apically; second division of male mesosome somewhat more narrow.....	
..... <u>pipiens pallens</u> Coquillett 12/	
21. Pleuron with some patches of pale scales.....	22
Pleuron unscaled.....	24
22. Abdomen with lateral rectangular pale ochreous patches on the tergites, forming a continuous pale lateral border; proboscis pale beneath (and usually at sides) for its whole length..... <u>modestus</u> Ficalbi	
Abdominal tergites and proboscis dark.....	23
23. Pleuron with horizontal reddish brown spots or stripes divided by a paler area bearing a broad horizontal stripe of pale scales; male palpus longer than proboscis <u>fuscocephalus</u> Theobald	
Pleuron almost uniformly colored, scales in irregular patches; male palpus appearing twisted, about five-eighths as long as proboscis..... <u>brevipalpis</u> (Giles)	
24. Male palpus about two-fifths as long as proboscis..... <u>sumatranus</u> Brug	
Male palpus about three-quarters as long as proboscis..... <u>hayashii</u> Yamada	
25. Abdomen unbanded dorsally.....	26
Abdomen banded dorsally.....	28
26. Pleuron pale brown; male antenna with 3 setae on segment VI, short tufts on VII to IX, 3 long setae on X and thickened hairs on X and XI; male genitalia with a subapically swollen dististyle and only 3 bristles in inner dorsal margin of basistyle; male palpus longer than proboscis..... <u>rubithoracis</u> Leicester	

12/ This subspecies is somewhat intermediate between pipiens and quinquefasciatus.

- Pleuron with dark markings across the upper part; male antenna without unusual setae; male palpus very short..... 27
27. Vertex mostly covered with broad appressed and with upright scales; male genitalia with dististyle forked less than half way to the base.....malayi (Leicester)
- Vertex mostly covered with narrow curved and with upright scales; male genitalia with dististyle subtriangular, not forked; basistyle with 6 subapical leafletsfoliatus Brug
28. Pleuron without distinct markings; male antenna with short setae on segment VIII and longer setae on IX..... 29
- Pleuron with a dark stripe across the upper part; male antennae with usual bristles only..... 30
29. Male genitalia with lateral arm of mesosome ending in a slender curved process covered with variously shaped small plates or flattened tubercles.....infantulus Edwards
- Male genitalia with lateral arm of mesosome moderately stout and smooth.....minutissimus (Theobald)
30. Decumbent scales of median area of vertex mostly broad; male palpus about twice as long as clypeus; male genitalia with dististyle forked less than halfway to the base.....malayi (Leicester)
- Decumbent scales of median area of vertex restricted to a border around eyes; male palpus longer than proboscis; dististyle not forked but with a backward pointing spiny crest..... 31
31. Scutal scales deep brown, male palpus with only a few long hairs on last 2 segments; narrow scales of vertex light brown.....shebbearei Barraud
- Scutal scales dark fawn, male palpus with numerous long hairs on last 2 segments; narrow scales of vertex light brown.....pallidothorax Theobald

Key to Larvae 13/

1. Comb in a single or partially double line of not more than 8 teeth..... 2
- Comb in a patch of many teeth..... 6
2. Antennal tuft inserted at or before middle of shaft; pecten of a few very inconspicuous teeth at extreme base of siphon, latter 6 to 8 times its basal diameter and with four small pairs of hair tufts..... 3
- Antennal tuft inserted beyond middle of shaft..... 4
3. Subapical antennal bristles inserted close to apical ones; mentum bordered with a large number of minute teeth.....bitaeniorhynchus Giles
- Subapical antennal bristles placed nearly halfway between apex of antenna and tuft; mentum with some large teeth toward apex.....sinensis Theobald

13/ Larvae of the following species appear to be unknown: aurantapex Edwards, orientalis Edwards and rubithoracis Leicester.

4. Siphonal hair tufts all less than half as long as tube; siphon with 6 to 7 pairs of ventral tufts and 2 small lateral tufts.....vishnui Theobald
- At least one siphonal hair tuft more than half as long as tube..... 5
5. Siphon 4 to 5 times its basal diameter, slightly curved upwards, with 5 to 6 pairs of long two-branched ventral hairs and 2 pairs of shorter lateral hairs, pecten of 8 to 14 teeth.....whitmorei (Giles)
- Siphon hardly one and one-half times its basal diameter, with 3 or rarely 4 pairs of multiple tufts differing greatly in length, pecten of 2 to 4 sharp and almost simple teeth.....sumatranus Brug 14/
6. Pecten extending almost the entire length of tube, ventral tufts as long as tube; gills short; mouth brushes thickened and prehensile.....
-vorax Edwards, halifaxii Theobald, and fuscus Wiedemann 15/
- Pecten not extending more than one-half the length of tube; mouth brushes not prehensile..... 7
7. Siphon with two dark areas, one around base and the other a broad median band.....
-(infantulus Edwards and minutissimus (Theobald)
- Siphon without a median dark band..... 8
8. Anal gills shorter than saddle and rounded apically..... 9
- Anal gills longer than saddle..... 10
9. Siphon with about 5 pairs of rather long ventral tufts in a zigzag row; pecten extending half the length of tube, apical teeth with only about 5 denticles.....modestus Ficalbi
- Siphon with about 6 pairs of tufts one of which is lateral; pecten extending along basal two-fifths of tube, apical teeth with numerous denticles; preclypeal spines black, short and very stout.....sitiens Wiedemann
10. Upper and lower head hairs (C and B) short, not reaching beyond apex of head..... 11
- Upper and lower head hairs reaching beyond apex of head..... 13
11. Siphon tufts less than twice as long as greatest siphon breadth, siphon 5 to 6 times its basal diameter.....malayi (Leicester)
- Siphon tufts at least twice as long as greatest siphon breadth..... 12
12. Anal gills about as long as saddle; apical pecten teeth very long and slender and with a large number of small denticles of approximately equal sizehayashii Yamada
- Anal gills considerably longer than saddle.....foliatus Brug 16/
- 14/ The description of this larva was taken from Edwards and Given (1928) who, according to Barraud (1934), mistakenly ascribed it to curtipalpis Edwards.
- 15/ Recent authors agree that the larvae of these three species cannot be reliably distinguished.
- 16/ The original description (Brug, 1932) was not clear on this point. Length of the gills is assumed by inference from Brug's remarks.

13. Antennal tuft inserted about at middle of shaft.....	14
Antennal tuft inserted beyond middle of shaft.....	15
14. Siphon tapering from base to apex, not swollen before middle; pecten of 14 to 18 teeth	<u>shebbearei</u> Barraud
Siphon swollen toward middle, very narrow at apex; pecten of 5 to 9 teeth.....	<u>pallidothorax</u> Theobald
15. Anal gills markedly unequal in length; siphon either very long or short and swollen before the middle.....	16
Anal gills nearly equal, or other characters not as above.....	17
16. Siphon about 3 to 4 times its basal diameter, somewhat swollen toward middle, with 4 pairs of moderate ventral tufts.....	<u>gelidus</u> Theobald
Siphon 12 to 14 times its basal diameter; not swollen toward middle, with about 5 pairs of minute hair tufts.....	<u>brevipalpis</u> (Giles)
17. Preclypeal spines long, slender, pale and curved.....	18
Preclypeal spines stout, black and usually straight.....	20
18. Siphon about 4 times its basal diameter, apical half distinctly tapering, pecten usually of 10 or 11 teeth.....	<u>quinquefasciatus</u> Say
Siphon about 5 times its basal diameter, apical half or at least apical third with essentially parallel sides.....	19
19. Pecten of 12 to 15 comparatively small teeth, mentum with about 25 teeth; basal siphon tufts longer than median diameter of tube.....	<u>vagans</u> Wiedemann and <u>pipiens pallens</u> Coquillett 17/
Pecten of 10 to 11 comparatively large teeth, mentum with about 15 teeth; basal siphon tufts shorter than median diameter of tube.....	<u>fuscocephalus</u> Theobald
20. Apical pecten teeth stout, with a strong curved apical tooth and 3 or 4 subbasal teeth; siphon 4.5 to 5.5 its basal diameter.....	<u>theileri</u> Theobald
Apical pecten teeth more slender and with more denticles.....	21
21. Siphon tufts at least twice median diameter of tube, about 10 in number and unpaired; comb teeth with a terminal spine.....	<u>mimeticus</u> Noe
Siphon tufts hardly longer than median diameter of tube; more or less in pairs.....	22
22. Comb teeth with an apical spine; pecten extending nearly half the length of tube.....	<u>jacksoni</u> Edwards
Comb teeth fringed apically.....	23
23. Anal gills about as long as anal segment; apical pecten teeth with 3 to 5 denticles....	<u>tritaeniorhynchus</u> Giles
Anal gills longer than anal segment; apical pecten teeth usually with 6 denticles.....	<u>mimulus</u> Edwards

17/ According to Barraud (1934), larvae of these two species are indistinguishable.

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